

September 9, 2008

VIA ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Notification of Ex Parte Presentation*
PS Docket No. 07-114, WC Docket No. 05-196

Dear Ms. Dortch:

On September 8, 2008, Lolita Forbes, Larry Rybar and Susan Sherwood of Verizon Wireless, together with the undersigned, met with Ron Repasi, James Miller, and Ahmed Lahjouji of the Office of Engineering and Technology, Ziad Sleem of the Wireless Telecommunications Bureau, Paul Marrangoni of the Public Safety and Homeland Security Bureau, and Robert ("Chip") Fleming of the International Bureau to discuss technical issues relating to location technologies for CMRS E911 services. The attached presentation summarizes the points made by Verizon Wireless during this meeting.

In accordance with Section 1.1206(b) of the Commission's rules, this letter is being filed electronically with your office. Please contact the undersigned if you have any questions.

Sincerely,

/s/

Adam D. Krinsky

cc: Ron Repasi
James Miller
Ahmed Lahjouji
Ziad Sleem
Paul Marrangoni
Robert ("Chip") Fleming

E-911 Technology Issues and Solutions



**Presentation to OET E-911 Working Group
September 8, 2008**

Agenda



- **Overview**
- **Supplemental Technologies Framework for Review**
- **Supplemental Technology Evaluations**
- **VZW E-911 Technology Solution Activities**

Verizon Wireless Two-Front Approach



1. Continue to make incremental enhancements in what we have...A-GPS/AFLT

- Process improvements
- Enhancements from Qualcomm
- LADS units

2. Evaluate supplemental location technologies

- To help where A-GPS/AFLT does not perform well
- Hybrid of A-GPS + AFLT + “x” ???

E-911 Activities Underway



- **Team Formed to evaluate supplemental E-911 and Location-Based Service (LBS) Technology**
 - Network Planning: single point of contact for E-911/LBS strategy and vendor evaluation process
- **Vendor meetings**
 - Meetings held with major supplemental location technology vendors
 - Understand technology solutions
 - Discuss potential trials
 - Meetings held with A-GPS/AFLT vendor (Qualcomm)
 - Understand technology roadmap

Hybrid



- **Definition: Integrate measurement data from independent, diverse location technologies into a single unified solution.**
- **An overlay on an existing system by itself will not achieve a genuine hybrid solution.**
- **VZW employs a hybrid solution, A-GPS/AFLT.**
- **A-GPS/AFLT is the best location solution on the market but it will not meet PSAP level accuracy in all markets.**
- **Location vendors themselves do not claim that a hybrid solution will meet PSAP level accuracy in all markets.**

A-GPS/AFLT



- **Best E-911 location solution available today.**
- **VZW research indicates that no solution is available in the short run that is better than VZW's current solution.**
- **Very accurate, high yield, good Time to Final Fix (TTFF).**
- **But, has some known trouble spots:**
 - Indoors
 - High Rise Urban Canyon
 - Dense Forest

Supplemental Technology Issues



- **Do vendor claims match up with reality? Do vendor technologies offer commercially deployable solutions or are they raw capabilities?**
 - **Do the supplemental technologies provide better accuracy than A-GPS/AFLT?**
 - **What is the timeframe for developing and deploying a hybrid solution of A-GPS/AFLT + “x”?**
- * More testing of supplemental technologies will be necessary to determine which hold promise.***

Framework for Evaluating E-911 Solutions



- **Two types of considerations must be examined in reviewing any E911 location solutions: performance and operations**

- **Performance Considerations**
 - Time to fix < 30 seconds, preferably < 15 seconds
 - No Audio blanking
 - Multipath performance
 - Indoor performance
 - Power/strength of signal
 - Tight clocking of signal
 - Geometry of signal
 - Coverage of signal (nationwide)

Framework for Evaluating E-911 Solutions (cont'd)



■ Operational Considerations

- Must integrate with A-GPS/AFLT
- Maintainable (Operations impact)
- Handset Cost/Impact
- Network Cost/Impact
- “Fit” with existing E-911 infrastructure
- Engineering effort
- Confidence in technology to deliver

■ Any review must take each of these issues into account

Steps Toward Implementation of Supplemental Technologies



- **Evaluate supplemental technologies**
- **Test location technologies in test bed**
- **Prove solutions to be practical**
- **Develop Industry Standards**
 - Standard interfaces for new technologies to integrate with the E-911 ecosystem
- **Build and Test Phase**
 - Work with vendors to integrate solution in handsets and network as required
 - Lab Tests
- **Deployment Phase**
 - Deploy in the field, test thoroughly before launch
- **Mass Market Rollout**
 - Will take years to get significant handset penetration, if required
- * ***Implementation of a Supplemental Technology solution: a multi-year undertaking.***

Supplemental Technologies Under Evaluation



- **U-TDOA**
- **CDMA RF Fingerprinting**
- **WiFi RF Fingerprinting**
- **900 MHz Beacons**
- **TV Position Augmentation**
- **Kalman Filtering**

U-TDOA



Network-based, Uplink Time Difference of Arrival (U-TDOA) / Angle of Arrival (AOA)

- Theoretical hybrid solution. Real-time solution not yet available for testing with CDMA
- U-TDOA and AGPS/AFLT function entirely independent of one another and may not integrate well enough to provide the synergies posited
 - A potential hybrid solution of A-GPS/AFLT + “U-TDOA” requires cooperation between different competing location vendors
- Unclear how U-TDOA vendor’s proposed hybrid approach addresses the problem of in-building location fixes
- Performance indoors, in urban canyons and in challenging rural areas (forested) may not be any better than existing AGPS/AFLT performance
- No capability to calculate altitude location information

CDMA RF Fingerprinting



CDMA pattern matching technique comparing existing network measurements (e.g. signal strength, time delays) against Predicted Signature Database

- Real-time solution not available for CDMA-2000 testing
- Requires an enormous database to be constructed and calibrated continuously – lots of room for error
- Unclear whether the solution can integrate with A-GPS/AFLT
 - **Potential hybrid solution requires cooperation between competing location vendors**
- No capability to calculate altitude location information
- Will not help in rural areas with few cell sites
- Unclear how this solution will improve indoor performance since calibration is done by driving test vehicles on the streets, not indoors

WiFi RF Fingerprinting



WiFi Pattern Matching

- Requires an extensive WiFi reference database that is built and maintained by continual drive testing...lots of room for error
- WiFi access points are continually in a state of churn raising questions of how this affects performance
- Unclear how this will improve performance indoors given that drive testing occurs on the streets
- WiFi components will increase size, cost and complexity of every device
- Not yet implementable for E-911. No end-to-end product that can, for example, transport location information from the handset back to MPC, a prerequisite for delivery to PSAPs
- Potential A-GPS/AFLT + "WiFi" hybrid solution also requires cooperation between competing location vendors
- Uses unmanaged spectrum, which may be of concern for mission critical E-911 application
- Unclear whether this technology will help in rural areas
- No capability to calculate altitude location information

900 MHz Beacons



900 MHz beacon technology, with location tag on device, communicates with network of receivers at 910 MHz band (unlicensed)

- Requires integration of a location tag on the wireless device. Adds cost, complexity and size
- There is no nationwide network of receivers to provide full coverage
- Not yet implementable for E-911. No end-to-end product that can, for example, transport location information from the handset back to MPC
- A potential hybrid solution of A-GPS/AFLT + “900 MHz beacons” also requires cooperation between competing location vendors
- Also uses unlicensed unmanaged spectrum

TV Position Augmentation



Uses TV signals via new chipset and existing TV towers to triangulate a location

- Not yet implementable for E-911. No end-to-end product that can, for example, transport location information from the handset back to MPC
- Unclear whether triangulation will work in many cities, where TV broadcast antennas are located in antenna farms, or in rural areas, where there are few TV stations
- While TV signal power yields good indoor penetration, both signal power and stable and precise timing are needed to achieve accurate location fixes. TV signals have poor clocking and poor geometry, leading to large location errors from multipath
- Another RF band in handsets will significantly increase size, cost and complexity, particularly for lower RF TV signal band which will likely require large TV antenna.
- To date, test devices are available solely from the vendor. Not clear that they are representative commercially available phones in terms of components, cost and size.
- A potential hybrid solution of A-GPS/AFLT + “TV” requires cooperation between competing location vendors
- Solution may not work in bad weather or when the handset is not stationary

Kalman Filtering



Vendor claims the use of their proprietary Kalman Filtering technique will improve A-GPS/AFLT performance

- Kalman Filtering is a well known engineering technique
- Time to Fix is increased dramatically over A-GPS/AFLT
- This technique may degrade A-GPS/AFLT fixes under some conditions
- This solution may not improve A-GPS/AFLT indoors, urban canyons and dense forest